SY120 COMMISSIONING PLAN
4/23/03-CDM

PRE-BEAM TO P3

1 Power supply check out by the EE Support Department.
2 Polarity checks by the beamline physicist.
3 Power supply stability by the beamline physicist (BP) and/or operations department.
4 Instrumentation check out by RFI and BP
5 General check out of control system readouts BP and operations department.
6 Play TLG, time line generator, i.e., checkout new time line generator module (#196).
7 Play TLG and power supplies
8. Run P3 beamline quads
9. Establish $21 event and send beam to M. I. Dump.
Ramp File 1
Tune File 4
RF File 11
Chromaticity File 9
Safeguards: kicker cable and disable beam synch.
10. Beam sign off at 4:30 PM
11. P3 dipoles power up
12. Take TeV orbits, monitor tunes, lifetime, lossesl ,….

Single Turn Low Intensity Beam to SY Dump

0. Check that all systems are made up and permits are all ok, beam switch off

1. Check that the vacuum is good and that the gate valves are open for

A. the P3 line (page T18_Beamline)
B. and the Switchyard (T18_Switchyard)

2. Make sure the proper curves are in the power supply control cards to ensure the current in the magnets is correct (page S15 for SY, page W38 for P1, P2, and P3). Trims should be set to zero To start with keep present values in P1, P2 line except for the P2 line quads which will be set back to the values for the precious SY120 extraction.
3. MSEP at proper position and voltage
4. Verify that the Instrumentation pages appear to be operational and set up flash on S40
5. Put a $21 in the time line and verify that:
   A. The P1, P2, and P3 line magnets are ramping with no beam,
   B. the extraction kicker is firing (beam switch?)(put cable back on)
   C. the kicker is appropriate for 120 GeV beam.
   D. the B3 switch magnet is off for the $21 cycle. 6.Insert SWICs in Switchyard dump line (page)
7. Ask for two turns, 30 bunches, one batch on the $21, one pulse every 30 seconds

START

0 Flip the beam switch _ TeV at 150 GeV

1 The beam will be tuned to the SY dump utilizing the BPM and wire data with the trim magnets.
2 Once beam is safely on the dump as indicated by the S:S106 SWIC systematic investigations will begin of:
   - Polarities of trims
   - Polarities of BPMs, SWICs, and Multiwires
   - Wire size comparison to TRANSPORT predictions

- Wire size changes with change of quad currents and comparison to TRANSPORT predictions
- Determination of trim transfer constants for Autotune
- Determination of the effect of the two main bend supplies
- Loss in TeV after inserting P3 MWs one by one

Of course any of these studies may have to be done to get beam to the SY dump.

COMMISSIONING OF RESONANT EXTRACTION

1. Ramps will be developed for the P1 and P2 lines on cycle 21 that have a one-second flat top.
2. Closed orbit bumps will be installed to steer the beam away from the extraction septa. This implies new closed orbits for all cycles and all energies – at least 4 to 8 hours. A time bump will probably be necessary on the 21 cycle.
3. The extraction septa will have their proper high voltage and they will be moved to the extraction position.
4. Since 3/4 of the Q206 and Q308 family of quadrupoles will be missing the correction of the

intrinsic half-integer stop band of the MI will be more difficult. We can set the currents to correct for the old measured value and according to John Johnstone we may be able to measure in a different way.

5. The horizontal tune will be moved in approximately 200 milliseconds to a value of 26.486.
6. At this point the Q206 system of quadrupoles will be ramped up to start extracting the beam.
7. The Switchyard style resonant BPMs in the P1, P2, P3, and Switchyard lines along with Multiwires and SWICs will be used to tune the beam to the SY Dump using the trims. The resonant beam may not have the same orbit as the single turn beam but the momentum should be the same so the main bends should not have to be tuned. The resonant BPMs do not work yet (4/16/03).
8. Continue Autotune studies to determine offsets to dump.
9. Manual Autotune mode tests with offsets to dump
10. Test stability and robustness of Autotune to dump.
11. The effect of the TeV ramp on the beam needs to be quantified.

Issues relating to single turn beam to the SY Dump:

6. The groundwater limit has been determined by Peder Yurista[1] using the conservative Single Resident Well (SRW) model which was standard at the time. This limit was determined to be 8E16 800 GeV protons per year. The dump is relatively short in the longitudinal dimension and if we scale by the energy ratio to the .8 power (a factor of 4.55) we are being conservative since more of the cascade will be contained. Also Peder used a very conservative estimate of the velocity of the

tritium (7.2 feet per year). If we use the upper limit[2] of tritium flow in modern estimates (1.312 feet per year) then we gain another factor of 4.32. Hence we are up to a limit of 1.587E18 protons per year or 3.17E6 pulses per year at 5E11 protons/pulse.

7. A Heating and Environmental Analysis of the SY Dump[3] was performed for the 1999 Fixed Target Run. This analysis indicated that thermal considerations permitted 45 pulses/hour for 1E13 800 GeV protons on the dump for ten hours. If we simply scale to 5E11 120 GeV protons then we find a capability of 6000 pulses per hour. Even with a two second rep rate we could only have 1800 pulses per hour.
8. The analysis in item number 2 specifically did not consider single turn beam so we must consider this. The inner portion of the beam dump is a 12”X16”X72” slab of Aluminum. Stefanski and Palmer[4] calculated that a 10 degrees C rise in temperature would cause Aluminum to reach its yield point. A MARS calculation by Richard Ford[5], utilizing realistic beam size parameters from a TRANSPORT run performed by Thomas Kobilarcik, shows that for a single pulse of 5E11 120 GeV protons incident on the Aluminum block that the instantaneous heat rise is 1.3 degrees C 50 centimeters into the block. Hence we are far away from the yield limit, one could also ask what could happen to this small region but we are far away from this limit.